

Reliability Test Station

Update

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G A T O R
Engineering



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Overview

- Review
 - Motivation
 - System Specification & Features
 - System Hardware
- Current Status
- Challenges & Solutions
- Future Work
- Sample Data

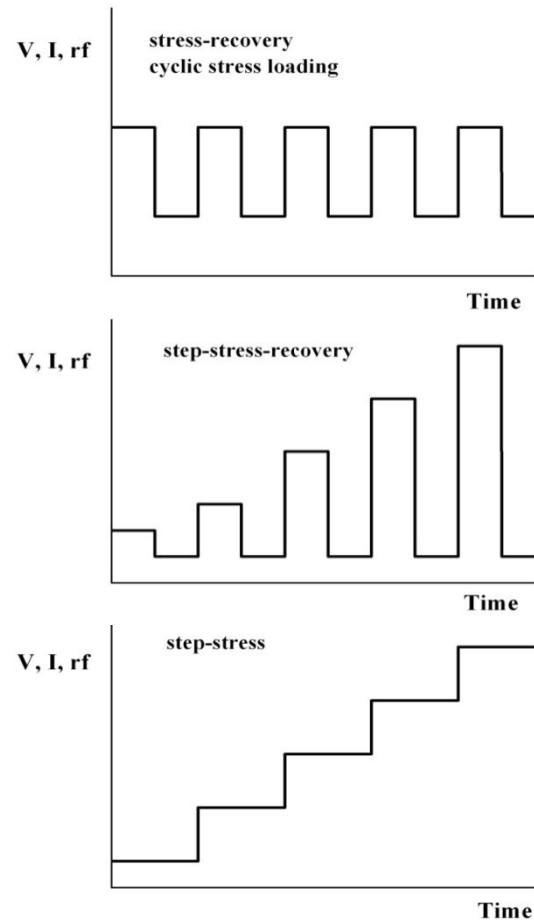
Review Motivation

	Turnkey		In-house
Timeline	Purchase lead time		On-going
System	Proven/Widely-used		Custom design
Objective	Predict life expectancy		Research Determine failure mechanisms
Test Types	Life Test/Burn-in		Flexible
DC	Drain Gate	0-100V, up to 4A, 400W max ±18.5V, up to 200mA	0-60V, up to 6A, 300W max ±10V, up to 20mA
	RF	600MHz-3 GHz 2-18 GHz 58-60 GHz	900MHz-10GHz 36-40 GHz 76-78 GHz
	Temperature	50° to 250° C	25° to 150° C
	Optical	NA	Research with wavelength and intensity
	Thermal Imaging	NA	IR, Micro Raman additional hardware
	Pulse	1-100kHz	1-100kHz+
Data Storage	Independent test files		SQL database

System Specifications & Features

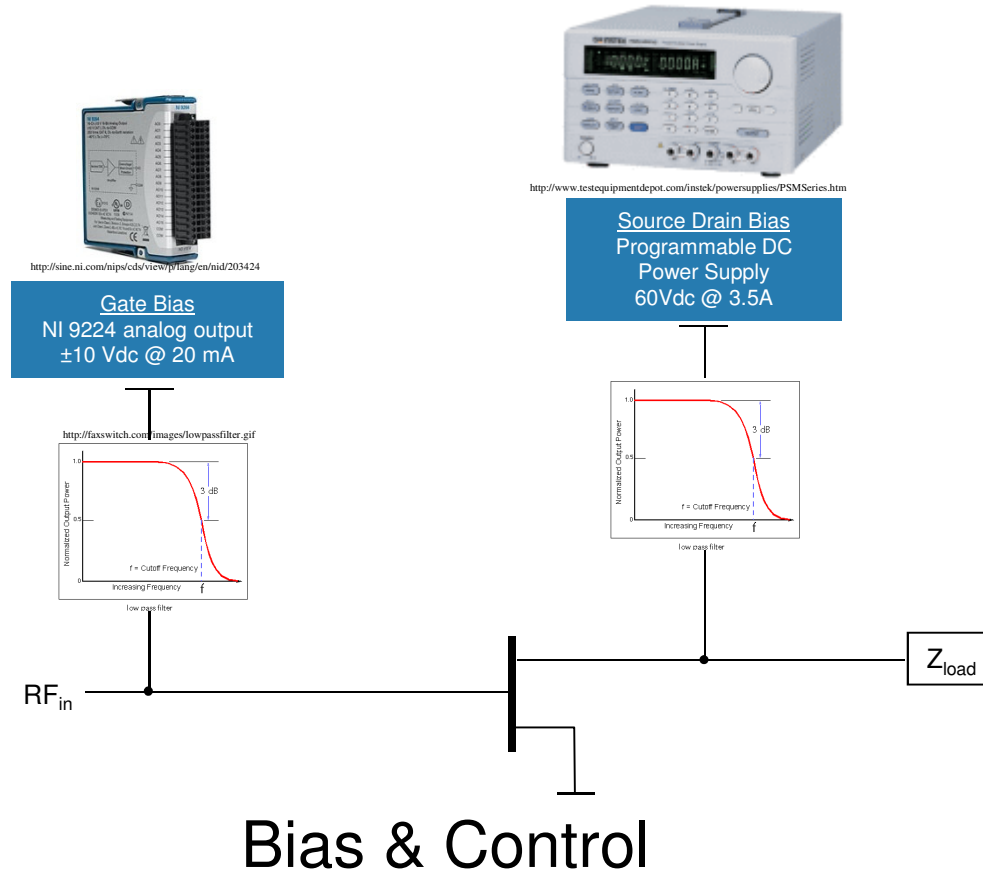
- 16 Device Capacity
 - Individual device control
 - Gate bias
 - $\pm 10\text{Vdc}$ up to 20mA
 - 0-60Vdc, 6A max, 300W max
 - Drain bias
 - 0-60Vdc, 6A max, 300W max
 - Over-current & over-voltage protection
 - Temperature
 - 25-150° C Peltier heating
 - PID control
 - Controlled in groups of 4

System Specifications & Features

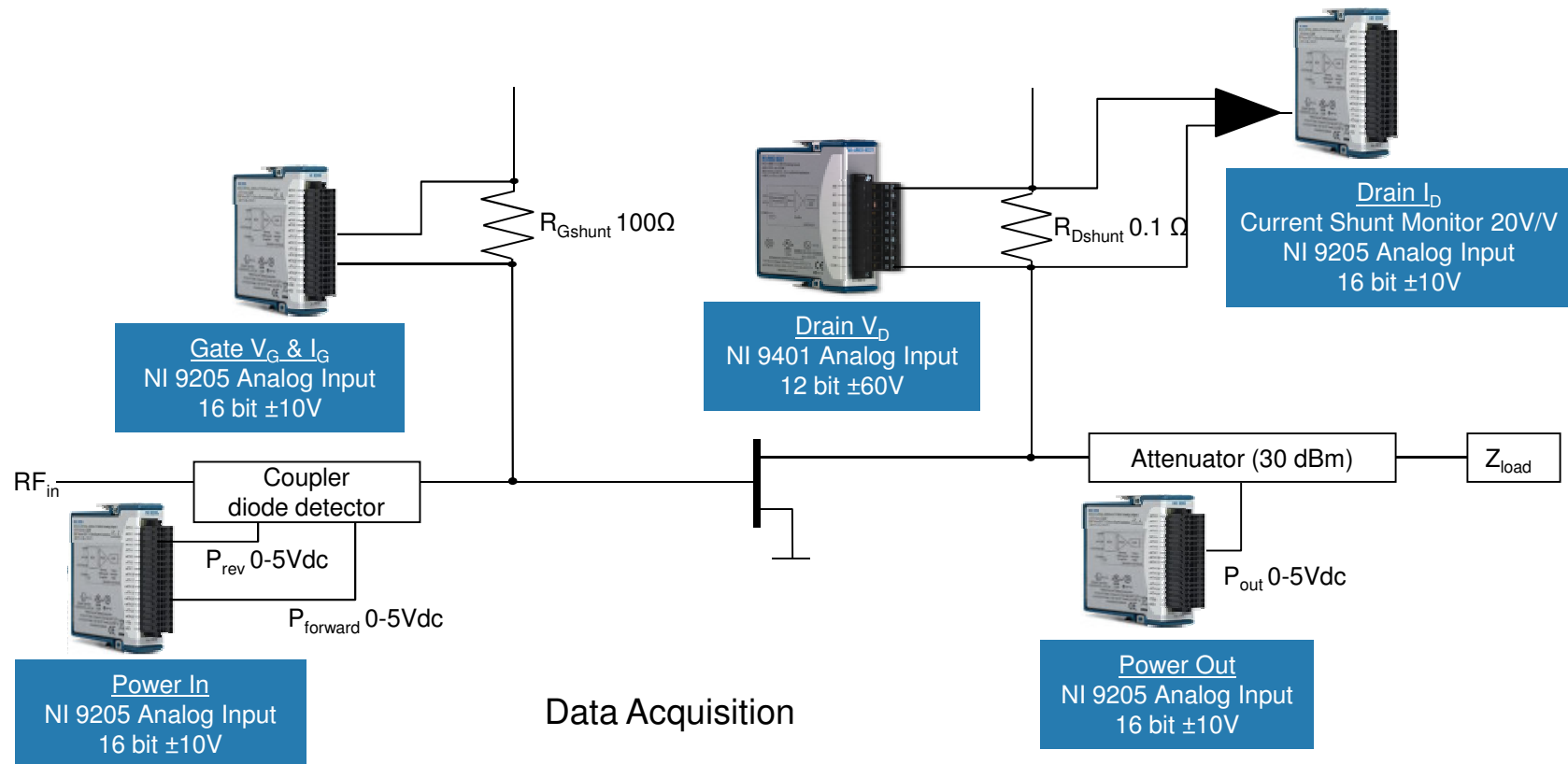


- Long-term DC Stress
 - Types
 - Stress-recovery
 - Step-stress-recovery
 - Step-stress
 - Device Characteristics
 - IV curve
 - Transfer curve, V_T
- Gate Pulse Test (Gate Lag)
- RF Stress
 - 2 GHz

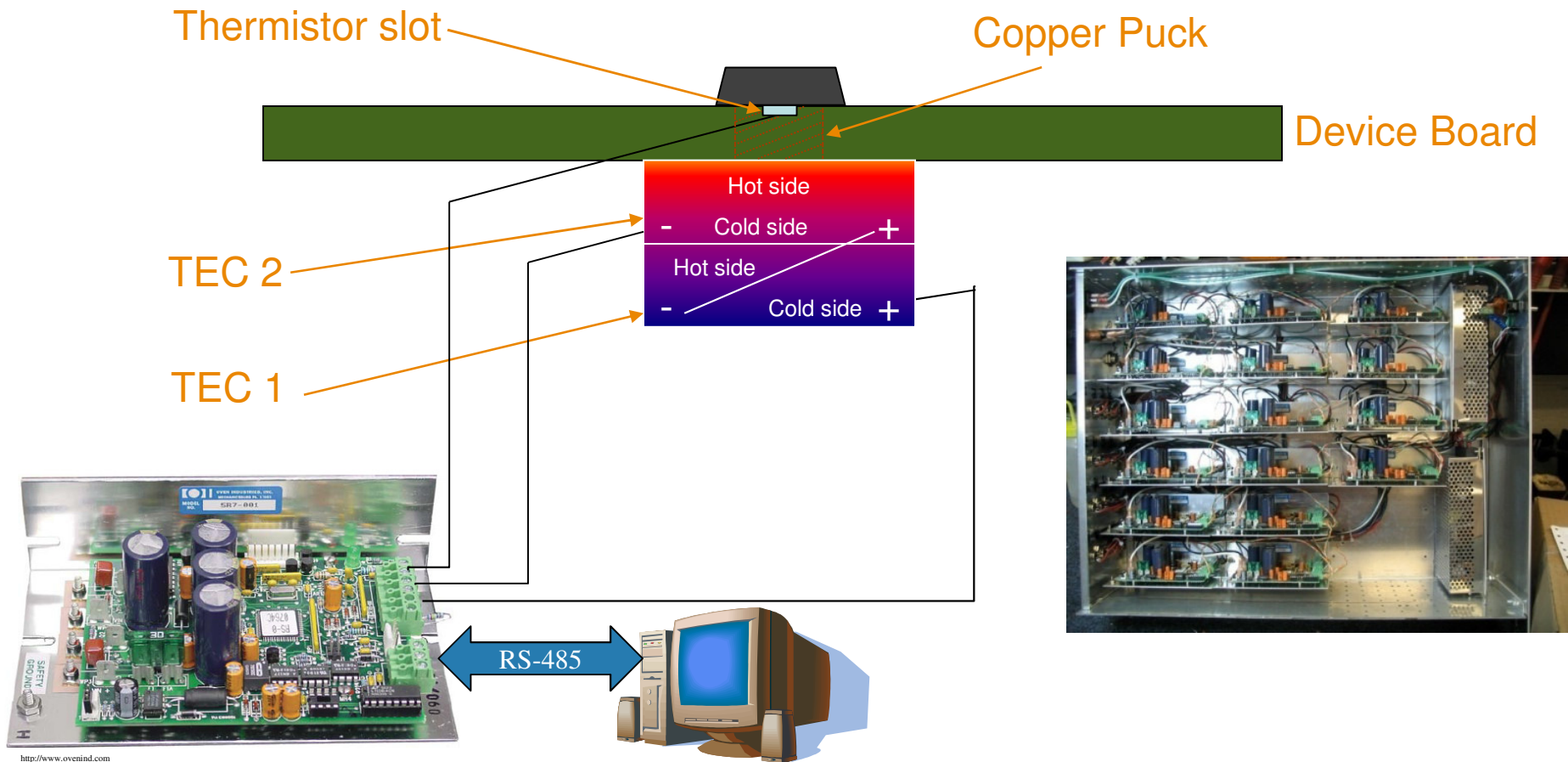
Review System Hardware



Review System Hardware



Review System Hardware



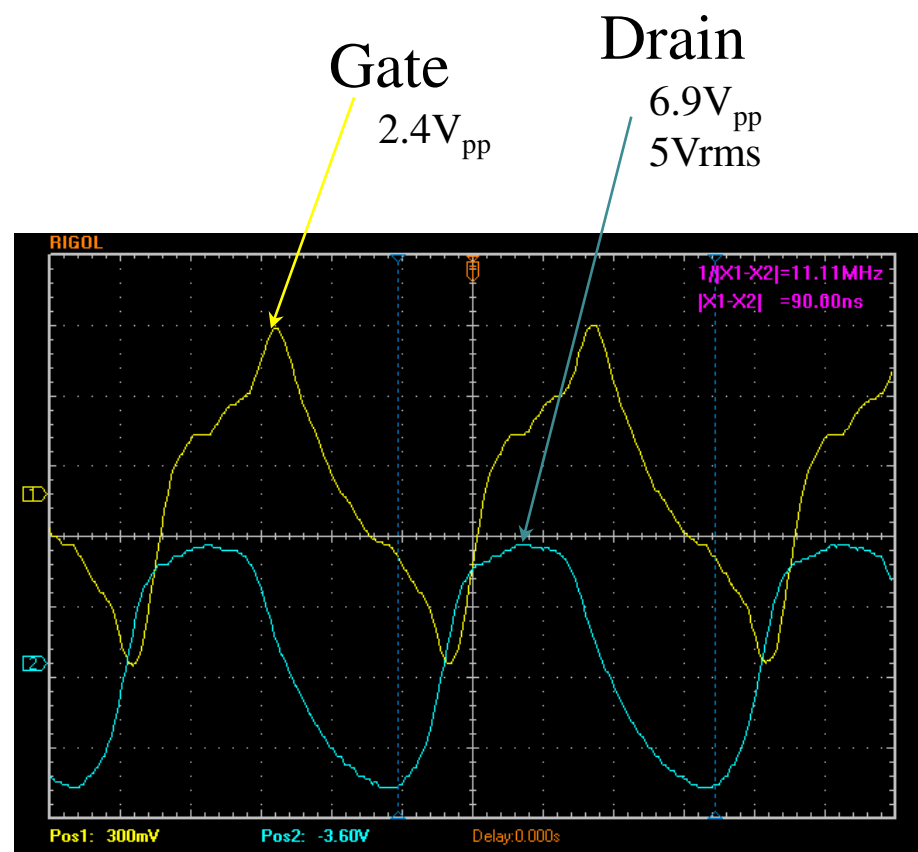
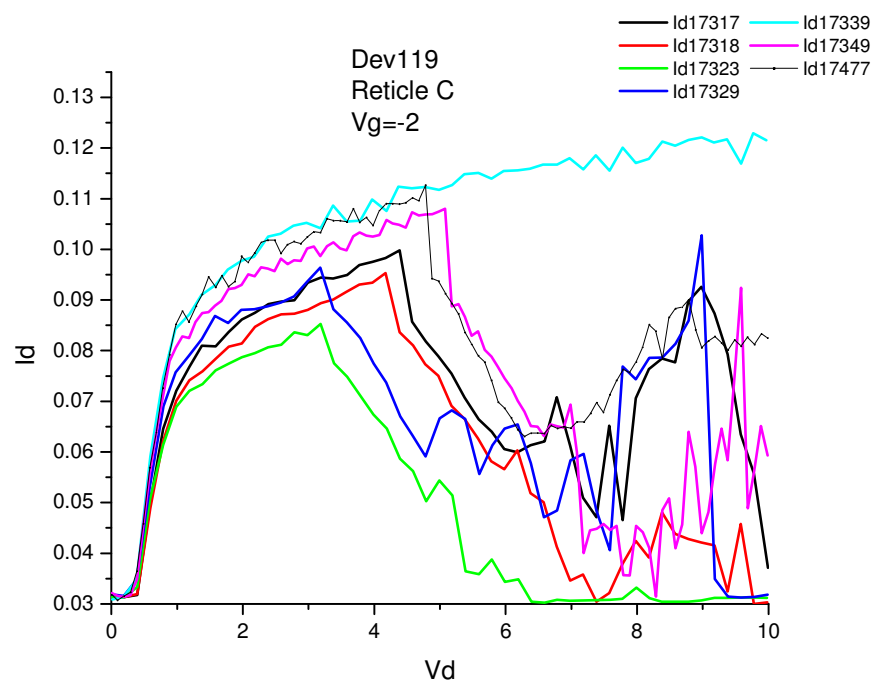
Temperature Measurement and Control

Current Status

- ✓ 8 functional channels
 - ✓ Control application is scalable by groups of four
 - ✓ Multiple instances of application to control four channels
 - ✓ Allows for independent testing
 - ✓ Assemble boards to reach full capacity
- ✓ DC test
 - ✓ Step/Stress/Recovery
 - ✓ IV & Gm characterization
- ✓ Sequencing
 - ✓ Hardcoded 5 levels

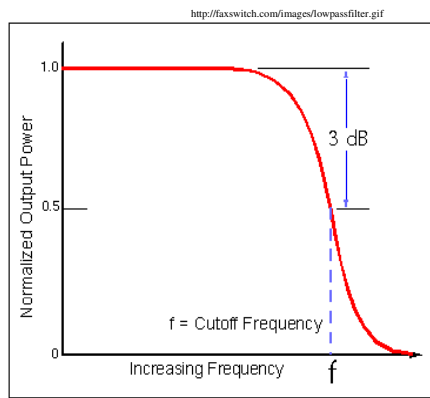
Challenges & Solutions

OSCILLATIONS



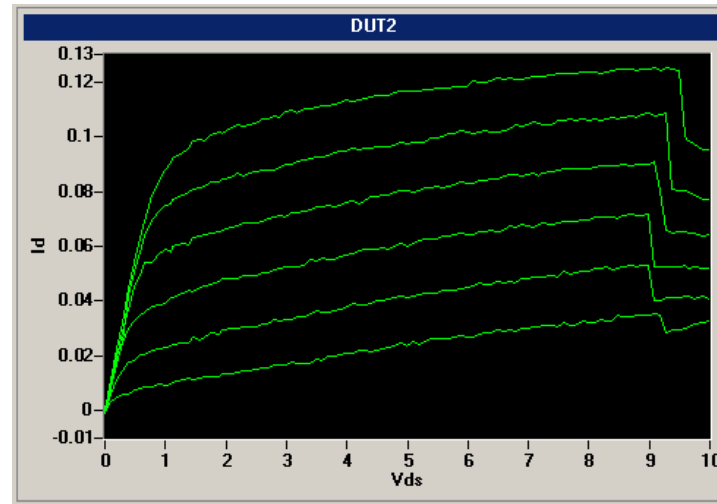
Challenges & Solutions

CLEAN DC

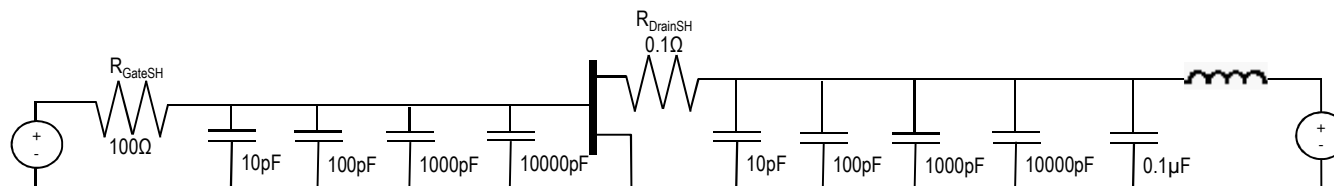


low pass filter

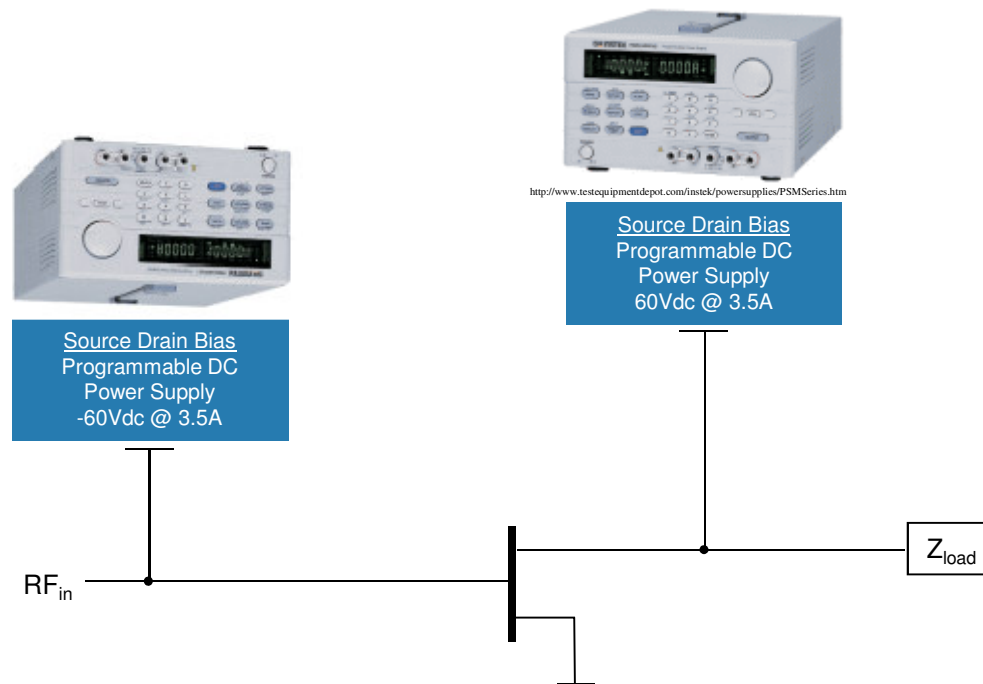
$R=100$
 $C=.011111 \mu\text{F}$
 $f=143\text{kHz}$



$V_g: -3 \text{ to } -2$



Future Work



Gate Stress Bias & Control

Future Work

Specialized Channels

Control Software	Channels	Features
1	1-4	V_D : 0 to 60V V_G : ± 10 V Pulse: 1kHz
2	5-8	V_D : 0 to 60V V_G : ± 10 V Pulse: 1kHz
3	9-10	V_D : 0 to 60V V_G : -60 to 0V Pulse: 1MHz Precision measurement
4	13-16	V_D : 0 to 60V V_G : ± 10 V Pulse: 1kHz Precision measurement

Future Work

- Gate Control with a second power supply
 - Precise multi-range gate current measurement
- Constant drain current testing
 - Feedback on bias voltages
 - Feedback loop Temperature & Power
 - Feedback loop I_D to V_G
- Measure R_D , R_S
- Sequencing